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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/585,682	06/01/2000	Kei-Yu Ko	3526.2US(97-1136.2)	7481

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EXAMINER	
CHU, CHRIS C	
ART UNIT	**PAPER NUMBER**
2815	

DATE MAILED: 11/01/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/585,682	KO ET AL.	
	Examiner	Art Unit	
	Chris C. Chu	2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 August 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 - 13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 - 13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *9/8/03&5/24/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment filed on August 3, 2004 has been received and entered in the case.

Information Disclosure Statement

2. The information disclosure statements (IDS) submitted on 9/8/03 and 5/24/04 were filed after the mailing date of the non-final Office actions on 5/30/03 and 5/5/04. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1 - 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Blalock et al. '344 in view of Lur '240.

Regarding claim 1, Blalock et al. discloses in e.g., Fig. 2 and column 6, lines 8 – 30 a semiconductor device, comprising:

- a semiconductor substrate (18) including an active surface;
- at least one conductive line (17) disposed upon the active surface, the at least one conductive line being flanked by sidewall spacers (19);
- a cap (16) disposed over and in contact with the at least one conductive line;
- a passivation layer (14) over the cap that may be composed of doped glass (e.g., column 6, line 14); and
- at least one contact aperture (12a) defined through the passivation layer and including at least one sidewall extending substantially perpendicularly relative to the semiconductor substrate, at least a portion of the at least one sidewall terminating at an interface between the passivation layer and the cap.

Blalock et al. discloses that the cap layer may be composed of silicon nitride, but Blalock et al. does not disclose the material of the cap layer may be undoped silicon dioxide. Lur teaches in e.g., Fig. 3B and column 5, lines 29 – 35 a BPSG layer (26) formed over an etch stop cap layer (28). The material of the cap layer (28) may be undoped silicon dioxide as well as silicon nitride. Thus, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to modify Blalock et al. by using the undoped silicon dioxide as the material of the cap layer as taught by Lur. The ordinary artisan would have been motivated to modify Blalock et al. in the manner described above because Lur teaches that silicon dioxide and silicon nitride were known functionally equivalent materials for etch-stopping BPSG.

As to the language on line 2 of claim 2, "a word line", applicant should note that this is merely function language that does not differentiate the claimed apparatus from Blalock et al.

Regarding claim 3, Blalock et al. discloses in e.g., Fig. 2 and column 6, lines 8 – 30 the passivation layer (14) comprising doped silicon dioxide.

Regarding claim 4, Blalock et al. discloses in e.g., Fig. 2 and column 6, lines 8 – 30 the passivation layer comprising borophosphosilicate glass, phosphosilicate glass, or borosilicate glass.

Regarding claim 5, Blalock et al. and Lur disclose the undoped silicon dioxide cap being at least partially exposed through the at least one contact aperture.

Regarding claim 6, Blalock et al. discloses in e.g., Fig. 2 and column 6, lines 8 – 30 a semiconductor device, comprising:

- a semiconductor substrate (18);
- at least one insulating structure (16); and
- at least one doped silicon oxide structure (14) over the at least one insulating structure and having at least one sidewall substantially perpendicular to a plane of the semiconductor substrate, at least a portion of the at least one sidewall terminating at an interface between the at least one doped silicon dioxide structure and the at least one insulating structure.

Blalock et al. does not disclose the material of the insulating structure being an undoped silicon dioxide. Lur teaches in e.g., Fig. 3B and column 5, lines 29 – 35 the material of the insulating structure (28) being an undoped silicon dioxide. Thus, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to modify Blalock et al.

by using the undoped silicon dioxide as the material of the insulating structure as taught by Lur. The ordinary artisan would have been motivated to modify Blalock et al. in the manner described above for at least the purpose of (1) providing an etch-stopping layer for the doped silicon dioxide (BPSG) layer, (2) decreasing in capacitance between the interconnect and other interconnects by using the undoped silicon dioxide instead of silicon nitride, and (3) providing a lower dielectric constant by using the undoped silicon dioxide instead of silicon nitride.

Regarding claim 7, Blalock et al. discloses in e.g., Fig. 2 and column 6, lines 8 – 30 the at least one sidewall comprising a sidewall of an aperture (12a).

Regarding claim 8, Blalock et al. discloses in e.g., Fig. 2 and column 6, lines 8 – 30 the at least one sidewall at least partially defines an aperture (12a) through the doped silicon oxide structure (14).

Regarding claim 9, Blalock et al. discloses in e.g., Fig. 2 and column 6, lines 8 – 30 the at least one doped silicon oxide structure comprising borophosphosilicate glass, phosphosilicate glass, or borosilicate glass.

Regarding claim 10, Blalock et al., as modified, discloses in e.g., Fig. 2 and column 6, lines 8 – 30 the at least one undoped silicon oxide structure being at least partially located over a conductive structure (17).

Regarding claim 11, Blalock et al., as modified, discloses in e.g., Fig. 2 and column 6, lines 8 – 30 the at least one undoped silicon oxide structure comprising an insulative cap over a conductive line.

Regarding claim 12, Blalock et al., as modified, discloses in e.g., Fig. 2 and column 6, lines 8 – 30 the insulative cap being partially exposed through an aperture of the at least one doped silicon oxide structure defined by the at least one sidewall.

Regarding claim 13, Blalock et al., as modified, discloses in e.g., Fig. 2 and column 6, lines 8 – 30 the at least one undoped silicon oxide structure being at least partially exposed adjacent the at least one sidewall.

Response to Arguments

5. Applicant's arguments filed August 3, 2004 have been fully considered but they are not persuasive.

On page 4, applicant argues "Lur does not teach or suggest that undoped silicon oxide is useful as an etch stop when anisotropic etching processes are employed ... Blalock and Lur would not have provided one of ordinary skill in the art with any motivation to combine the teachings of these references in such a way as to replace the silicon nitride caps of Blalock with an undoped silicon oxide etch stop, as taught in Lur." This argument is not persuasive because as long as some motivation or suggestion to combine the references is provided by the prior art taken as a whole, the law does not require that the references be combined for the reasons contemplated by the inventor. Furthermore, Lur teaches that the undoped silicon oxide is an etch stop during "conventional dry or wet etching" (column 4, lines 35 – 36, column 5, lines 10 - 18). As such Lur does not teach the use of undoped oxide as an etch stop during conventional etch processes.

Furthermore, applicant argues "it is respectfully submitted that one of ordinary skill in the art would have had no reason to expect that the asserted combination of teachings from Blalock and Lur would have resulted in the structures recited in claims 1-13 of the above-referenced application. If the undoped silicon oxide etch stop were merely substituted for the silicon nitride layer of Blalock, due to lack of selectivity for the disclosed etchant between doped and undoped silicon oxides, etching of the overlying doped silicon dioxide layer would continue on into the undoped silicon dioxide film ... Therefore, one of ordinary skill in the al't would have no reason to expect the asserted combination of teachings from Blalock and Lur to be successful." This argument is not persuasive since Blalock does not state an etchant between doped and undoped silicon oxides lacks selectivity and Lur discloses in column 5, lines 16 – 18 and lines 29 – 32 that the undoped silicon dioxide layer (28) is utilized as an etch-stopping layer to stop the etch of the BPSG layer (26; doped silicon oxides). Thus, the combined structure of Blalock and Lur teaches etching of the overlying doped silicon dioxide layer would not continue on into the undoped silicon dioxide film, as taught in Lur. Furthermore, applicant argues "Lur lacks any teaching or suggestion of an anisotropic etch process that may be used to remove doped silicon oxide with selectivity over undoped silicon oxide." This argument is not persuasive because the invention, as set forth in the claims, is clearly directed to an apparatus. Nowhere do the limitations of the claims define the process in which the instant invention is to be manufactured. Thus, such arguments clearly fail to distinguish the claimed invention from the disclosure of Blalock and Lur.

Finally, applicant argues "it appears that any motivation to combine the teachings of Blalock and Lur in the asserted manner could only have been improperly gleaned from the hindsight provided by the disclosure of the above-referenced application." This argument is not persuasive because Lur also teaches in column 5, lines lines 16 – 18 and lines 29 – 32 that the motivation of silicon dioxide and silicon nitride were known functionally equivalent materials for etch-stopping BPSG.

For the above reasons, the rejection is maintained.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chris C. Chu whose telephone number is 571-272-1724. The examiner can normally be reached on 11:30 - 8:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 517-272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Chris C. Chu
Examiner
Art Unit 2815

c.c.
Tuesday, October 19, 2004

GEORGE ECKERT
PRIMARY EXAMINER